

What is Claimed is:

1. A process for increasing the loading efficiency of an oligosaccharide into eukaryotic cells comprising:

5 providing eukaryotic cells having a first phase transition temperature range and a second phase transition temperature range which is greater than the first phase transition temperature range;

disposing the eukaryotic cells in an oligosaccharide solution for loading an oligosaccharide into the eukaryotic cells; and

10 heating the oligosaccharide solution to the second phase transition temperature range to increase the loading efficiency of the oligosaccharide into the eukaryotic cells.

2. The process of Claim 1 additionally comprising uptaking external oligosaccharide via fluid phase endocytosis from the oligosaccharide solution.

3. The process of Claim 1 wherein said eukaryotic cells are selected from the group of eukaryotic cells consisting of mesenchymal stem cells and epithelial 293H cells.

4. The process of Claim 1 wherein said second phase transition temperature range is 20 greater than about 25°C.

5. The process of Claim 3 wherein said second phase transition temperature range is greater than about 25°C.

25 6. The process of Claim 1 wherein said eukaryotic cells do not include a fixative.

7. The process of Claim 3 wherein said eukaryotic cells do not include a fixative.

8. The process of Claim 4 wherein said second phase transition temperature ranges  
5 from a temperature greater than about 25°C to a temperature less than about 50°C.

9. The process of Claim 5 wherein said second phase transition temperature ranges  
from a temperature greater than about 25°C to a temperature less than about 50°C.

10. The process of Claim 8 wherein said second phase transition temperature ranges  
from about 30°C to less than about 50°C.

11. The process of Claim 9 wherein said second phase transition temperature ranges  
from about 30°C to about 40°C.

12. The process of Claim 11 wherein said second phase transition temperature ranges  
from about 32°C to about 38°C.

13. The process of Claim 1 wherein said oligosaccharide is trehalose.

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14. The process of Claim 5 wherein said oligosaccharide is trehalose.

15. An eukaryotic cell composition comprising eukaryotic cells loaded internally with  
an oligosaccharide from an oligosaccharide solution at a temperature greater than about 25°C.

16. A process for increasing the survival of dehydrated eukaryotic cells after storage comprising:

5 providing eukaryotic cells from a mammalian species;

loading the eukaryotic cells with a preservative;

dehydrating the eukaryotic cells while maintaining a residual water content in the eukaryotic cells greater than about 0.15 gram of residual water per gram of dry weight eukaryotic cells to increase eukaryotic cell survival upon rehydrating after storage;

storing the dehydrated eukaryotic cells having the residual water content greater than about 0.15 gram of residual water per gram of dry weight eukaryotic cells; and

10 rehydrating the stored dehydrated eukaryotic cells with the stored dehydrated eukaryotic cells having an increase in survival following dehydration and storage.

17. The process of Claim 16 wherein said preservative comprises an oligosaccharide.

18. The process of Claim 17 wherein said oligosaccharide is trehalose.

19. The process of Claim 16 additionally comprising cooling the loaded eukaryotic cells to a temperature below their freezing point prior to dehydrating the eukaryotic cells.

20. The process of Claim 19 wherein said dehydrating the eukaryotic cells comprises lyophilizing the cooled loaded eukaryotic cells.

21. The process of Claim 18 additionally comprising cooling the loaded eukaryotic cells to a temperature below their freezing point prior to dehydrating the eukaryotic cells.

22. The process of Claim 21 wherein said dehydrating the eukaryotic cells comprises  
5 lyophilizing the cooled loaded eukaryotic cells.

23. The process of Claim 16 wherein said residual water content of the eukaryotic cells ranges from about 0.20 gram of residual water per gram of dry weight eukaryotic cells to about 0.75 gram of residual water per gram of dry weight eukaryotic cells.

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24. The process of Claim 22 wherein said residual water content of the eukaryotic cells ranges from about 0.20 gram of residual water per gram of dry weight eukaryotic cells to about 0.75 gram of residual water per gram of dry weight eukaryotic cells.

25. A process of preparing loaded eukaryotic cells comprising:  
providing eukaryotic cells selected from a mammalian species; and  
loading an oligosaccharide into the eukaryotic cells at a temperature greater than about 25°C to produce loaded eukaryotic cells.

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26. The process of Claim 25 wherein said loading comprises loading with an oligosaccharide solution.

27. The process of Claim 26 wherein said loading comprises uptaking external oligosaccharide via fluid phase endocytosis from the oligosaccharide solution at the temperature greater than about 25°C.

5 28. The process of Claim 26 wherein said loading comprises incubating the eukaryotic cells at the temperature greater than about 25°C with the oligosaccharide solution.

29. The process of Claim 25 wherein said loading is without a fixative.

10 30. The process of Claim 25 wherein said oligosaccharide is trehalose.

31. The process of Claim 25 wherein said loading of the oligosaccharide into the platelets is at a temperature ranging from greater than about 25°C to less than about 50°C.

32. The process of Claim 31 wherein said temperature ranges from about 30°C to less than about 50°C.

15 33. The process of Claim 31 wherein said temperature ranges from about 34°C to about 37°C.

20 34. The process of Claim 25 wherein said eukaryotic cells are human eukaryotic cells selected from the group of eukaryotic cells consisting of mesenchymal stem cells and epithelial 293H cells.

35. Loaded eukaryotic cells produced in accordance with the process of Claim 25.

36. A solution for loading eukaryotic cells comprising eukaryotic cells selected from a mammalian species; and an oligosaccharide solution containing the eukaryotic cells and a 5 temperature greater than about 25°C for loading oligosaccharide from the oligosaccharide solution into the eukaryotic cells.

37. The solution of Claim 36 wherein external oligosaccharide is uptaked via fluid phase endocytosis from the oligosaccharide solution at a temperature ranging from about 30°C to less than about 50°C.

38. The solution of Claim 36 wherein said solution does not include a fixative.

39. The solution of Claim 36 wherein said oligosaccharide is trehalose.

40. The solution of Claim 36 wherein said temperature ranges from about 30°C to about 40°C.

41. The solution of Claim 40 wherein said temperature ranges from about 34°C to 20 about 37°C.

42. A generally dehydrated composition comprising:

freeze-dried eukaryotic cells selected from a mammalian species and being effectively loaded internally with at least about 10 mM trehalose therein to preserve biological properties during freeze-drying and rehydration.

5 43. The generally dehydrated composition of Claim 42 wherein the amount of trehalose loaded inside the freeze-dried eukaryotic cells is from about 10 mM to about 50 mM.

44. The generally dehydrated composition of Claim 42 wherein the freeze-dried eukaryotic cells comprise at least about 0.15 gram of residual water per gram of dry weight eukaryotic cells to increase eukaryotic cell survival upon rehydrating.

45. The generally dehydrated composition of Claim 42 wherein the effective loading includes incubating the eukaryotic cells at a temperature from about 30°C to less than about 50°C so as to uptake external trehalose via fluid phase endocytosis.

46. The generally dehydrated composition of Claim 42 wherein the mammalian species is human.

47. A process of preparing a dehydrated composition comprising:

20 providing eukaryotic cells selected from a mammalian species; loading internally the eukaryotic cells with from about 10 mM to about 50 mM of an oligosaccharide therein to preserve biological properties, said loading including incubating the eukaryotic cells at a temperature from about 30°C to less than about 50°C with an oligosaccharide solution having up to about 50 mM oligosaccharide therein;

cooling the loaded eukaryotic cells to below their freezing point; and lyophilizing the cooled eukaryotic cells.

48. The process of Claim 47 wherein the lyophilizing is conducted so as to remove  
5 less than about 0.85 gram of residual water per gram of dry weight eukaryotic cells.

49. The process of Claim 16 wherein greater than about 80% of the eukaryotic cells survive dehydration and storage.

50. The process of Claim 47 additionally comprising prehydrating the eukaryotic cells, and subsequently hydrating the prehydrated eukaryotic cells.